CAKN Stream Monitoring Program

2012 Field Season Report

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On the cover: Hidden Creek and Hidden Creek Lake in WRST. Hidden Creek Lake is dammed by the Kennicott Glacier, and is prone to annual outburst floods that can dramatically alter the Kennicott River. Hidden Creek was sampled in 2012 as part of the stream monitoring program.

Summary
During the 2012 field season, the Central Alaska Network (CAKN) Stream Monitoring Program made 130 site visits to 58 unique stream sites across the network (Figure 1), with each site being sampled one to five times from early May through late September. The data collected included instantaneous water chemistry, stream flow, water chemistry samples, macroinvertebrates, benthic diatoms, stable isotope samples, habitat data and environmental DNA samples. Continuous year-round temperature monitoring at 23 sites across the network is ongoing. At the request of DENA staff, the Stream Monitoring Program collected water chemistry, metals, invertebrates and diatoms from 7 sites in the Kantishna Hills. Active layer depth and continuous soil temperature data were collected for the 4th year at 2 CALM plots in WRST. A time-lapse camera was installed at Jack Creek in WRST to monitor flow, turbidity and the timing of freeze-up and break-up. Four site visits were made to the stream gage on the Nabesna River just outside of WRST to install a GOES satellite transmitter, perform station maintenance and collect discharge data. This gage is operated as a cooperative effort between CAKN, The US Fish and Wildlife Service and the NOAA River Forecast Center. The Stream Monitoring Program also coordinated the collection of northern pike from Lake Chilchukabena in DENA for mercury analysis as part of the WACAP followup study. Logistical problems led to the cancellation of data collection in YUCH. A final version of the CAKN Stream Monitoring Program 2010 Annual Report will be available as a Natural Resources Technical Report soon (Annual Reports for 2006-2009 are available at the CAKN website - http://science.nature.nps.gov/im/units/cakn/reportpubs.cfm). The Stream Monitoring Protocol, including a Protocol Narrative and 19 Standard Operating Procedures, is in peer review; a final version should be in publication as a Natural Resource Report within several months.

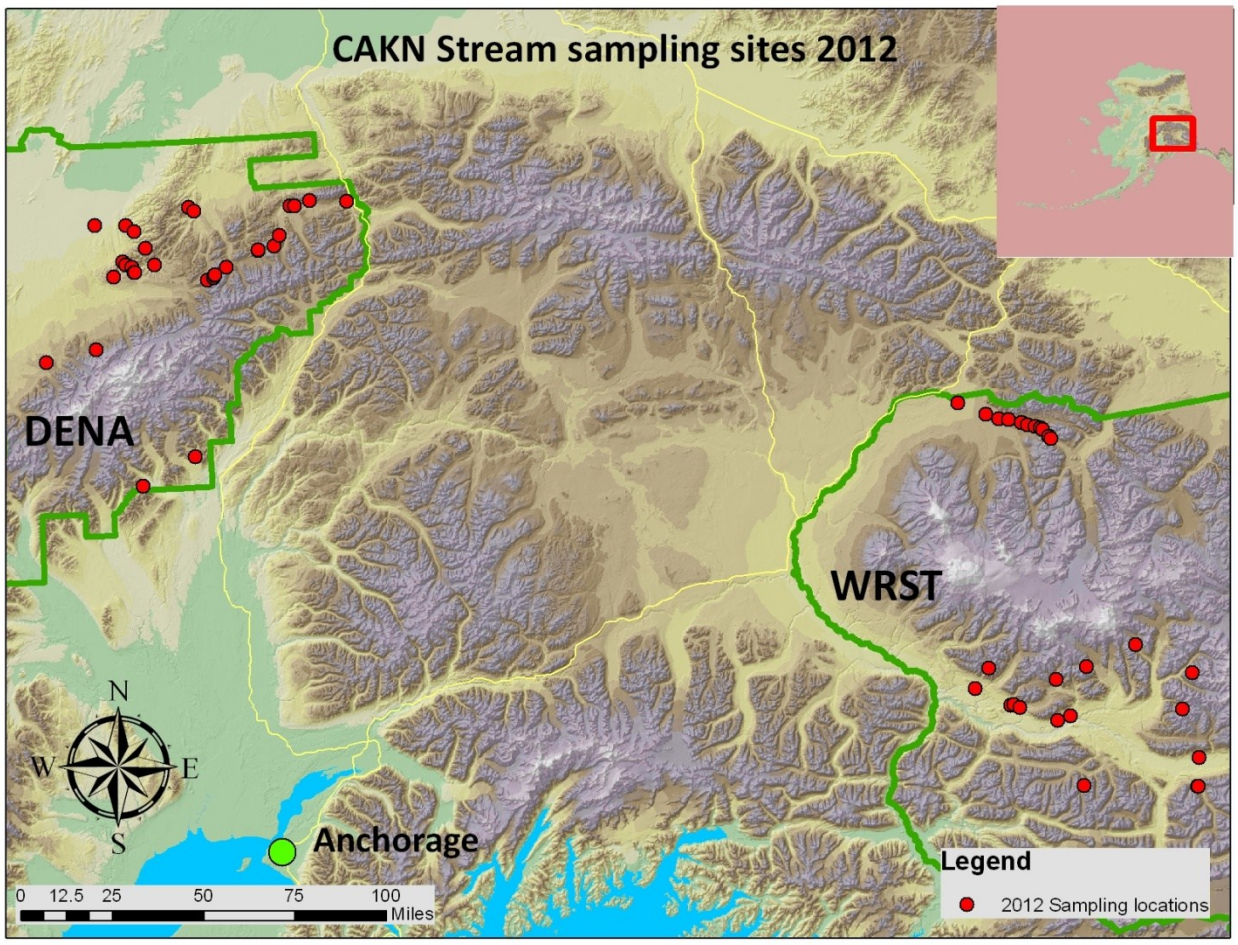

Figure 1. Locations of sites sampled by the stream monitoring program during 2012. Individual sites were sampled as many as 5 times from May to September.

Denali National Park and Preserve

There were four components to the field season in DENA in 2012. First, since 2008, continuously recording temperature loggers have been deployed in streams along the Park Road. At present, there are temperature loggers deployed at 13 sites (Table 1). Loggers are changed out every 2 years. In 2012, one recorder was changed out, and a new one deployed at the Wonder Lake inflow. Continuous temperature data will allow us to detect changes in the temperature regimes of park streams over time.

Secondly, as part of the ongoing stream monitoring program, 59 sampling visits were made to 30 unique sites in the park (Figure 1, Table 2). Data collected during these sampling visits included instantaneous water chemistry, habitat characteristics and stream flow, as well as water chemistry samples, stable isotope samples, invertebrate samples and benthic diatom samples. Starting in 2012, we are also collecting samples of environmental DNA, which will be used to detect the presence of fish species and other aquatic organisms. These data are used to evaluate status and trends in water quality, biodiversity and ecological integrity in park streams. Three types of sites are sampled – sentinel sites, GRTS sites, and judgment sites. Sentinel sites, all of which are along the park road, are sampled annually to maximize our ability to detect change. Many of these sites were originally part of the LTEM monitoring program. GRTS sites are selected using a probabilistic algorithm, allowing us to use

Table 1. Locations of currently-deployed continuous temperature recorders in DENA

Site Code	Site Name	Notes
DENA-001	Rock Creek	since 2009
DENA-008	Little Stony Creek	since 2008
DENA-011	Gorge Creek spring	since 2011
DENA-017	Tattler Creek	since 2009
DENA-021	Hogan Creek	since 2008
DENA-022	Savage River	since 2008
DENA-029	Lake Creek	since 2008
DENA-033	Gorge Creek spring	since 2009
DENA-034	Wonder Lake inflow	since 2012
DENA-GRTS-003	Stony Creek trib	since 2011
DENA-GRTS-010	Moose Creek	since 2008
DENA-GRTS-014	E.F. Toklat tributary	since 2009
DENA-GRTS-084	Igloo Creek	since 2008
DENA-GRTS-104	Sanctuary River	since 2008

data collected at these sites to infer conditions at sites that have not been sampled. Although some of these sites are also sentinel sites (due to a coincident location with an existing sentinel site), most are in the backcountry and are sampled approximately once every 10 years. Judgment sites are selected on an *ad hoc* basis, and for a variety of reasons. For example, the so-called "Travertine stream" along the park road near Stony Creek, has been sampled occasionally due to its unusual water chemistry. In 2012, we revisited a site (Wildhorse Creek) that was part of the 1994-1996 water chemistry study. Lake Creek was selected to make sure that a lake outlet stream was included in the set of sentinel sites, since their biogeochemistry and ecology are often quite different from other stream types.

Thirdly, in 2012, the stream monitoring program cooperated with Andrea Blakesley, the US Fish and Wildlife Service and the USGS to collect fish for a followup to the 2008 Western Airborne Contaminants Assessment Program (WACAP). The followup project was focused exclusively on mercury content, and targeted resident top-level piscivorous lake fish. Although our initial plans were to sample up to 5 lakes in the northwestern part of DENA, sampling difficulties and logistical constraints eventually led us to curtail the sampling to a single lake – Lake Chilchukabena, where a large number of northern pike were successfully captured and submitted for analysis.

Finally, the Stream Monitoring Program cooperated with DENA staff to collect data at historically mined sites in the Kantishna Hills (Table 2, marked with **). Several of these sites have or are scheduled to undergo stream restoration in an attempt to remediate damage that occurred during historical mining. These sites have been sampled for several years by the USGS, but that sampling did not continue into 2012. To maintain the continuity of the dataset, it was important to obtain comparable data during the 2012 field season. Accordingly, the Stream Monitoring program visited 7 sites in 2012, and collected instantaneous water chemistry and habitat data, as well as samples for water chemistry, trace metals, invertebrates, stable isotopes and benthic diatoms. These data will be used to assess the ongoing impacts of historical mining, as well as the effectiveness of stream restoration efforts.

Table 2. List of sites sampled in DENA in 2012

Site Code	Site Name	Notes
DENA-001	Rock Creek	Sampled annually, first LTEM site
DENA-004	Travertine stream	Unusual water chemistry, near Stony Creek
DENA-008	Little Stony Creek	Sampled annually, LTEM site
DENA-017	Tattler Creek	Sampled annually, LTEM site
DENA-021	Hogan Creek	Sampled annually, LTEM site
DENA-029	Lake Creek	Sampled most years
DENA-033	Gorge Creek spring	Sampled some years
DENA-034	Wonder Lake inflow	New site, will be sampled annually
DENA-035	Eureka Creek	Legacy mining impacts**
DENA-036	Friday Creek	Legacy mining impacts
DENA-GRTS-003	Stony Creek tributary	GRTS site, sampled annually, water very low in 2012
DENA-GRTS-007	Glen Creek	GRTS site, legacy mining impacts**
DENA-GRTS-010	Moose Creek	Sampled annually, GRTS site, LTEM site**
DENA-GRTS-014	E.F. Toklat tributary	Sampled annually, GRTS/LTEM site, aka Coal Cr.
DENA-GRTS-023	Last Chance Creek	GRTS site
DENA-GRTS-049	White Creek	GRTS site
DENA-GRTS-051	Clearwater Fork	GRTS site
DENA-GRTS-060	Savage River	GRTS site, will be sampled annually
DENA-GRTS-071	Stony Creek	GRTS site, dry in September
DENA-GRTS-084	Igloo Creek	Sampled annually, GRTS/LTEM site
DENA-GRTS-104	Sanctuary River	Sampled annually, GRTS/LTEM site
DENA-GRTS-122	Highway Pass Creek	Sampled annually, GRTS/LTEM site
DENA-GRTS-137	Bear Creek	GRTS site
DENA-GRTS-143	Birch Creek tributary	GRTS site
DENA-GRTS-196	Alder Creek	GRTS site, also part of 1994-96 WQ study
DENA-MINE-001	Stampede Creek	Legacy mining impacts**
DENA-MINE-002	Rock Creek	Control site for mining impacts**
DENA-MINE-003	Caribou Creek	Legacy mining impacts**
DENA-MINE-004	Slate Creek	Legacy mining impacts**
DENA-WQ-067	Wildhorse Creek	Part of the 1994-96 water quality study

"GRTS sites" are sites that were selected using an algorithm that generates a probabilistic, spatially-balanced list of potential sampling locations to maximize inference to conditions at unsampled sites.
**These sites were sampled at the request of DENA staff as part of an ongoing mining restoration project.

Wrangell-St. Elias National Park and Preserve

The field season in WRST in 2012 was similar to DENA, although some of the components of the stream monitoring program were different. First, since 2008, continuously-recording temperature loggers have been deployed at a number of sites in WRST, most of them at sites along the Nabesna and McCarthy roads. At present, there are temperature loggers deployed at 10 sites (Table 3). Loggers are changed out every 2 years. In 2012, seven recorders were changed out (Crystal Creek, Gilahina River, Rufus Creek, Long Lake Creek, Little Jack Creek, Rock Creek and Chalk Creek). Continuous temperature data will allow us to detect changes in the temperature regimes of park streams over time.

Secondly, as part of the ongoing stream monitoring program, 67 sampling visits were made to 28 unique sites in the park (Figure 1, Table 4). Data collected during these sampling visits included

Table 3. Locations of currently-deployed continuous temperature recorders in WRST.

Site Code	Site Name	Notes
WRST-004	Chalk Creek	Since 2008
WRST-006	Rock Creek	Since 2008
WRST-013	Gilahina River	Since 2008
WRST-015	Little Jack Creek	Since 2008
WRST-036	Rufus Creek	Since 2009
WRST-039	Caribou Creek	Since 2008
WRST-051	Long Lake Creek	Since 2008
WRST-060	Paco Creek	Since 2011, @ Mile 27 Nabesna Road
WRST-GRTS-032	Crystal Creek	Since 2010
WRST-GRTS-130	Jack Creek	Since 2008

instantaneous water chemistry, habitat characteristics and stream flow, as well as water chemistry samples, stable isotope samples, invertebrate samples and benthic diatom samples. Starting in 2012, we are also collecting samples of environmental DNA, which will be used to detect the presence of fish species and other aquatic organisms. These data are used to evaluate status and trends in water quality, biodiversity and ecological integrity in park streams. Three types of sites are sampled – sentinel sites, GRTS sites, and judgment sites. Sentinel sites, all of which are along the McCarthy and Nabesna Roads, are sampled annually to maximize our ability to detect change. Some of these sites are also sampled multiple times per year as a way to help quantify seasonal variability in ecological metrics. GRTS sites are selected using a probabilistic algorithm, allowing us to use data collected at these sites to infer conditions at sites that have not been sampled. Although a few of these sites are also sentinel sites (due to a coincident location with an existing sentinel site), most are in the backcountry and are sampled approximately once every 10 years. Judgment sites are selected on an *ad hoc* basis, and for a variety of reasons. For example, in 2012 I sampled a tributary to Toby Creek because it was a small clearwater stream (sourced in a rock glacier) in a high-elevation glacial valley. Similarly, we sampled Hidden Creek because it should be relatively ecologically isolated by the Kennicott Glacier. In both of these cases I was attempting to broaden the ecological scope of streams that have been sampled. This is a critical aspect of the overall sampling approach of the Stream Monitoring Program, because probabilistic sampling schemes do not necessarily capture the full range of ecological conditions across a landscape, something that is important for ecological modeling.

Thirdly, 2012 marked the 4th year of data collection at the Circumpolar Active Layer Monitoring (CALM) plots established in 2009 at two sites along the Nabesna Road in cooperation with the USGS. The global CALM network, established in 1991, is part of the NSF Arctic Observing Network (AON). The CALM network is an international effort containing more than 150 sites from 15 countries around the globe where long-term responses of the active layer and near-surface permafrost are observed. The two CALM plots in WRST are among the southernmost plots in North America. Each September, at the time of maximum thaw, 121 active-layer depth measurements are made in a grid overlaid on the one-hectare CALM plots in WRST. In addition, dataloggers deployed near the center of each plot record continuous soil temperature data at depths of 0.1, 0.5, 1 and 1.5 meters. The data are submitted annually to the CALM network and are publicly available.

Table 4. List of sites sampled in WRST in 2012.

Site Code	Site Name	Notes
WRST-004	Chalk Creek	Sampled annually
WRST-006	Rock Creek	Sampled annually
WRST-011	Rock Creek tributary	Sampled annually
WRST-013	Gilahina River	Sampled most years
WRST-015	Little Jack Creek	Sampled most years
WRST-036	Rufus Creek	Sampled most years
WRST-039	Caribou Creek	Sampled most years
WRST-040	Chokosna River	
WRST-051	Long Lake Creek	
WRST-060	Paco Creek	Sampled most years, at Nabesna Road mile 27
WRST-065	Toby Creek tributary	
WRST-067	Hidden Creek	
WRST-069	Trail Creek	Sampled most years
WRST-070	Lost Creek	Sampled most years
WRST-071	Boyden Creek	Sampled most years
WRST-072	Crystal Creek	
WRST-GRTS-021	Caribou Creek	GRTS site, sampled most years
WRST-GRTS-030	Strelna Creek	GRTS site, sampled most years
WRST-GRTS-126	Upper Strelna Creek	GRTS site
WRST-GRTS-130	Jack Creek	GRTS site
WRST-GRTS-174	Lakina River sidechannel	GRTS site
WRST-GRTS-244	Ultima Thule Creek	GRTS site, near Ultima Thule Lodge
WRST-GRTS-249	Monahan Creek	GRTS site
WRST-GRTS-296	West Fork Glacier tributary	GRTS site
WRST-GRTS-356	Copper Creek	GRTS site
Tomco-001	Toby Creek	Stable isotope sample for Patrick Tomco
Tomco-002	E.F. Kiagna River	Stable isotope sample for Patrick Tomco
Tomco-003	Kiagna River	Stable isotope sample for Patrick Tomco

"GRTS sites" are sites that were selected using an algorithm that generates a probabilistic, spatially-balanced list of potential sampling locations to maximize inference to conditions at unsampled sites.

Fourth, the Stream Monitoring Program began collaborating with Dr. Jeff Welker and Dr. Patrick Tomco from the University of Alaska Anchorage on a study of the effects of glacial recession on river biogeochemistry in the Copper River Basin. In 2012 I cooperated with Dr. Tomco to collect multiple samples for analysis of dissolved organic carbon and stable isotopes of hydrogen and oxygen from both remote and road-accessible sites in WRST.

Fifth, 2012 marked the first field season for the collaborative operation of the Nabesna River gaging station. This station, located a few miles downstream of WRST in Tetlin NWR, has been operated by the USFWS Water Resources Branch since 2007, but was scheduled to be removed in 2012. However, the CAKN Stream Monitoring Program has entered into a collaboration with the FWS Water Rights Branch, Tetlin NWR and the NOAA River Forecast Center to maintain the station indefinitely. Under this agreement, the CAKN Stream Monitoring Program is responsible for field data collection and station maintenance, Tetlin NWR provides staff time and logistical support, and the Water Rights Branch and NOAA are responsible for data management and analysis. In 2012, we made 4 visits to the gaging station (a 5th is scheduled for November). In March, a new datalogger and GOES satellite transmitter were installed, providing real-time stage data for the first time. During visits in May, July

and September, discharge measurements were made using an acoustic Doppler current profiler, and routine station maintenance was performed. Discharge data from this station, the only currently operating gage within or downstream of a network park, will be used to assess hydrologic conditions upstream in WRST.

Finally, in 2012 the Stream Monitoring Program launched an effort to monitor the dates of freeze-up and break-up, as well as obtain continuous qualitative estimates of flow and turbidity in streams and rivers in the CAKN using digital time-lapse cameras. The first camera was deployed in September on Jack Creek and will record high-quality images once per hour. In 2013 the program hopes to expand the network of cameras across all 3 CAKN parks.